COTTAGE POLLUTION CONTROL PROGRAM

District Municipality of Muskoka

Bala Bay
Dark Lake
Gull Lake
Silver Lake
Three Mile Lake

Provisional County of Haliburton

Gull Lake

1975

Ontario
Ministry of the Environment

P.G. Cockburn, P. Eng.
Regional Director
Central Region

COTTAGE POLLUTION CONTROL PROGRAM

1975

DISTRICT MUNICIPALITY OF MUSKOKA

BALA BAY	- TOWNSHIP OF MUSKOKA LAKES
DARK LAKE	- TOWNSHIP OF MUSKOKA LAKES
GULL LAKE	- TOWN OF GRAVENHURST
SILVER LAKE	- TOWN OF GRAVENHURST
THREE MILE LAKE	- TOWNSHIP OF MUSKOKA LAKES

PROVISIONAL COUNTY OF HALIBURTON

GULL LAKE	- LUTTERWORTH TOWNSHIP

The Cottage Pollution Control survey field work included in this report was carried out by staff of the Muskoka-Haliburton District Office.

The Water Quality Report on Gull Lake (Gravenhurst), Bala Bay, Dark Lake, and Three Mile Lake was prepared by the Technical Support Section, Central Region.

The Microbiology Report on Gull Lake (Gravenhurst) was prepared by the Microbiology Section, Ministry of the Environment.

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INFORMATION OF GENERAL INTEREST TO COTTAGERS

PREFACE

Ontario's thousands of beautiful inland lakes provide an abundant resource for recreational enjoyment. To protect the quality of these waters, a delicate environmental balance must be maintained.

A heavy influx of people may subject a lake and its surrounding environment to great stress. Uncontrolled development and imprudent use of our recreational lakes may cause their deterioration and destroy their natural qualities.

The Ontario Ministry of the Environment is attempting to bring some of these stress factors under control by a variety of programs; one of these, the Cottage Pollution Control Program was initiated in 1970 to study the cottage waste disposal problem, to evaluate existing waste disposal systems and to enforce repairs to those found to be unsatisfactory.

The Ministry is carrying on research to improve the knowledge of septic tank operation and the movement of sewage effluent in shallow soils. Alternative methods of private waste disposal are also being evaluated.

SUMMARY

The Cottage Pollution Control Program was established to detect and have corrected faulty private sewage disposal systems of cottages located on recreational lakes. The objective of the program is to investigate and, in conjunction with the owner, to undertake abatement work on those systems found to be faulty.

In 1975 a total of 1,448 private sewage disposal systems were inspected on Bala Bay, Dark Lake, Gull Lake, Silver Lake and Three Mile Lake in Muskoka and Gull Lake in Haliburton. The inspection of these systems indicated that 36% were performing satisfactorily, 21% were found to be seriously substandard, 35% were discharging wash water or solid waste onto the ground surface, 1% were direct polluters and 7% were unclassified after the initial detection survey. See appendix 1 for the summary of inspection results.

A total of 1,234 shoreline, control and drinking water samples were collected. Of these, 48% showed presence of faecal coliform bacteria, which are pollution indicators. It is stressed that these are individual samplings indicating only the water quality at the time of sampling. The Ministry of the Environment recommends that all surface water supplies used for drinking purposes should be disinfected as a precautionary measure.

As of December 31st, 1975, 140 agreements for corrective work to be carried out had been signed by the owners. Corrections have been completed and inspected for 99 systems and 300 letters have been sent to owners advising them that their systems are undersized and should be upgraded in the near future.

Contacts with owners are continuing during the winter to arrange for corrective action to be taken to systems in the spring of 1976.

COTTAGE POLLUTION CONTROL SURVEY

PREPARATION

During the winter of 1974, a reconnaissance and mapping program was undertaken by snowmobile on the lakes.

The snowmobile crews counted the number of establishments on the lake, photographed and described every one hundredth establishment on the shoreline, plotted the cottages on maps and located non cottage properties such as marinas, camp grounds and lodges.

Data obtained from the snowmobile work, as well as that from Cottagers' Associations and other agencies, was used to prepare a work schedule for the student crews in the summer.

Prior to the commencement of the survey of each lake, a meeting was held with the Cottagers' Association during which members were given a brief outline of the survey procedures to be followed and also the information that would be required from each cottager. In certain cases, a mid-summer meeting was arranged with the Association when abatement procedures were discussed. The co-operation of the Associations contributed greatly to the success of the program.

Detection Surveys

The crews, each composed of two students, began the survey of the lake by preparing a description log in which each establishment was systematically numbered and accurately described. Using this log, individual establishments can be easily located for follow-up inspections.

Each establishment was then inspected to determine the: type, size, location and design of sewage disposal systems; soils type and depth in the area of all tile beds; presence of leaching pits or privies, source of drinking water; and to provide data on other related factors.

A preliminary classification of all waste disposal systems was made by the students prior to referring the file to their supervisor for final classification.

Classification of Sewage Disposal Systems

The sewage disposal systems of all premises surveyed were classified into one of the following groups:

1. Satisfactory - the system meets all current standards of good design, construction and location, and is properly maintained.

2. Satisfactory (Acceptable) Performance - the system may not quite meet current standards of design and construction but is properly located with respect to distance from lake, well etc. and is maintained in good condition.

3. Seriously Substandard - a system which does not meet current standards of design, construction and location and/or is in a state of neglect. Although this system is not deemed to be causing pollution at the time of inspection, a potential hazard exists. The owner is notified of the deficiency and is advised that consideration should be given to updating the system in the near future.

4. Nuisance (Wash Water) - a system causing wash water to be exposed on the surface of the ground either directly through a waste pipe, escaping from a seepage pit or just thrown on ground surface. Such a condition is known as a Public Health Nuisance. Wash water discharged from any sanitary fixture is contaminated and creates an unhealthy environment. Phosphates and other nutrients from waste discharges encourage weed growth and affect the aesthetic quality of the lake.

5. Nuisance (Toilet and Solid Waste) - a system causing a waste containing faecal or urinary discharges to be exposed on the surface of the ground, either directly through a pipe or escaping from some part of the sewage disposal system including a privy. Also, included in this classification, is "solid waste" or garbage of a kind which can cause a "nuisance", e.g. domestic garbage containing food waste.

6. Direct Polluter - a system which is permitting sewage to contaminate the ground water or to reach the lake either by direct discharge through a pipe or ditch or over the ground surface.

Classification of Sewage Disposal Systems (Cont'd)

7. Unclassified (temporarily) - a system which has been given a preliminary classification by the student inspector where he feels he cannot use any of the preceeding classifications and has doubts about the system or part of it. These systems require further inspections by the supervisor who will attempt to make a final classification after a thorough investigation.

8. Unclassified - a system (or systems) where it is not possible at the end of the survey to make a classification at that time. Usually they amount to only a few abandoned premises.

WATER SAMPLING

The Public Health Laboratories provided the necessary water sample analyses to detect total and faecal coliforms in the lake water samples. These samples were important for the tracing of sources of pollution entering the lake. They were not taken in sufficient number or frequency to investigate the overall water quality of the lakes surveyed.

Drinking water samples were obtained when the cottager was using an untreated water supply. These samples were analysed at the Public Health Laboratory and any owner having a drinking water sample which showed unsatisfactory total or faecal coliforms was immediately informed to this effect and instructions were also sent regarding procedures for disinfecting the drinking water supply.

All lake water samples fell well within the criteria for total body contact recreational use of 1,000 total coliforms per 100 ml, and 100 faecal coliforms per 100 ml, as outlined in the Ministry of the Environment booklet "Guidelines and Criteria for Water Quality Management, July 1974".

A water quality study was conducted by the Ministry of the Environment, Technical Support Section on Bala Bay, Dark Lake, Gull Lake (Gravenhurst) and Three Mile Lake. The results of this study are included in this report.

CORRECTIVE PROCEDURE

After the file was examined by the supervisor and the original classification was confirmed, it was referred to the Abatement Officer. The Abatement Officer then interviewed the establishment owner to advise him of the findings and discuss corrective action. If the owner agreed with the findings, a corrective program was initiated; the owner signed an abatement agreement form stating the corrections which would be completed by a specific date. A final inspection is carried out upon completion of the corrective work and the sewage disposal system is appropriately reclassified.

In the case of commercial establishments, this procedure is often more complicated requiring an engineering study and the submission of plans for approval with soil analysis reports. In these instances, unless the system is a direct polluter, the owner is contacted and is instructed to submit plans for the corrective measures to be completed prior to the opening of the next commercial season. A direct polluter must take corrective action immediately to prevent pollution of the lake.

METHODS OF SEWAGE DISPOSAL

Much of the shoreline property in Muskoka-Haliburton has minimal soil over bedrock and therefore, is unsuitable, in its natural state, for sub-surface sewage disposal. This can be remedied in some areas by importing granular material over an area capable of supporting a sub-surface sewage disposal system. The use of a holding tank may provide a more economical solution for the disposal of sewage and may be recommended if a contract for the pump-out of the tank can be secured. On some lots where there is restricted space for a conventional sewage disposal system, the installation of a proprietary aerobic sewage treatment system may provide a viable alternative.

Recently there have been many developments in sewage disposal systems and the Ministry of the Environment is continually monitoring new systems which are marketed in Ontario.

The Ministry of the Environment or other designated authority should be consulted and approval obtained before any sewage disposal system is installed.

ABATEMENT PROGRESS FROM 1974 COTTAGE POLLUTION CONTROL PROGRAM

During the summer of 1974 the Cottage Pollution Control Program was conducted on the following lakes in the District Municipality of Muskoka, Bass, Clear, Harp, Kahshe and Wood as well as Twelve Mile Bay of Georgian Bay. A total of 1,110 private sewage disposal systems were inspected. Of these systems 32% were performing satisfactorily, 17% were found to be seriously substandard, 38% were discharging wash water or solid waste onto the ground surface, 4% were direct polluters and 9% were unclassified after the initial detection survey. All of the owners with seriously sub-standard systems were contacted and advised their system should be watched carefully and may require updating in the near future. As of April 1st, 1976 75% of the systems which required upgrading were completed. The majority of the remaining systems requiring upgrading have signed agreements by the owners for completion of corrective action during the summer of 1976.

Legal action will be initiated against the few remaining owners who have refused to respond to several attempts by Environmental Officers to have corrective action carried out.

BALA BAY AND DARK LAKE

Bala Bay and Dark Lake are located in the Township of Muskoka Lakes, District Municipality of Muskoka and are approximately 32 kilometers (20 miles) north west of the Town of Gravenhurst. Bala Bay lies in the south west section of Lake Muskoka, seperated from it by Wanilah and Bala Park Islands, which make up its north shore. Bala Bay is rectangular in shape with a peninsula at both ends, (the Community of Bala at the west end and Point Manchee at the east end). Dark Lake is a small round bay, contained within the Point Manchee peninsula at the east end of Bala Bay. There is a small channel joining Dark Lake and Bala Bay at the mid-point of the peninsula's south shore.

Bala Bay has a shoreline length of 14 kilometers (10 miles) and a maximum depth of 41 meters (134 feet). Dark Lake has a shoreline length of 1 kilometer (0.6 mile) and a maximum depth of 12.5 meters (41 feet).

The shoreline of Bala Bay and Dark Lake is dominated by rock and boulder till with areas of sandy gravel or clay overburden.

On Bala Bay, all of the 280 private sewage disposal systems were inspected. Of these systems, 72 or 26% were classified as seriously substandard, 91 or 33% were unsatisfactory due to improper disposal of solid waste or wash water and 5 or 2% were classified as direct polluters.

The 38 private sewage disposal systems on Dark Lake were inspected; 8 or 21% were classified as seriously substandard, 7 or 19% were unsatisfactory due to improper disposal of solid waste or wash water. There were no direct polluters on Dark Lake (see Appendix 1 for classification information).

SANITARY SURVEY OF THE COMMUNITY OF BALA

A sanitary survey of the Community of Bala was carried out by Environmental Officers of Central Regions, Muskoka-Haliburton District Office, in conjunction with the Cottage Pollution Control survey of Bala Bay.

A similar format to the Cottage Pollution Control Program was used for the Bala survey. A total of 229 establishments were inspected within the area defined for the Bala survey. One hundred and seventy-nine of these establishments were found to have adequately functioning sewage disposal systems. Thirty-five establishments were classed as having nuisance problems, particularly in the cottage areas. Frequently, the nature of the problem was wash water on the ground surface or a sub-standard privy. In the residential areas, the problems usually resulted from old septic systems which had become plugged or had broken weeping tiles.

A follow-up and abatement program was initiated to handle problem situations. Only four systems classed as direct polluters remained so as of January 1st, 1976.

* Copies of the report "Sanitary Survey of the Community of Bala, 1975" are available from the Ministry of the Environment, Muskoka-Haliburton District Office, Gravenhurst, Ontario.

WATER QUALITY - BALA BAY AND DARK LAKE

Design of the Survey

Seven stations were sampled on five separate occasions from June 12th to September 24th. They are listed below and shown on the map of Bala Bay.

a) four inlet stations (I-1 to I-4)

b) the outlet (O-1)

c) two lake stations (ML-1 - Bala Bay, depth - 40 m, ML-2 - Dark Lake, depth - 11.5 m)

During each visit, chemical samples were collected at the inlet and outlet stations plus an additional sample for chlorophyll _a_ determination from the inlets.

The following activities were conducted on each visit to midlake stations:

a) the degree of water transparency was determined using a Secchi disc (30 cm disc divided into opposing black and white quadrants)

b) dissolved oxygen and temperature profiles were recorded using an electronic meter.

c) euphotic zone composite samples for chemical and chlorophyll _a_ analysis were collected.

d) bottom water samples (1 meter above bottom) were collected for chemical analysis.

Analysis for the following parameters was performed on all chemical samples:

Alkalinity, hardness, conductivity, pH, total iron, total phosphorus, soluble phosphorus, total Kjeldahl nitrogen, ammonia-nitrogen, nitrate-nitrogen, nitrite-nitrogen, chloride, and colour.

RESULTS AND DISCUSSION *

Temperature and Dissolved Oxygen

Thermal stratification was evident at both lake stations on all sampling occasions. The maximum surface temperature measured during this study was 24 degrees celsius. The bottom water temperature (1 meter above bottom) in Bala Bay (ML #1) remained at approximately 4 degrees celsius. Slightly warmer temperatures (6 degrees celsius) prevailed in the bottom waters of Dark Lake.

Considerable disparity existed in the dissolved oxygen profiles measured at the two lake stations. The surface water concentration remained near saturation at both stations, but on the last survey date (September 24) (ML #2). The bottom water concentration in Bala Bay (ML #1) on this date was 7.5 mg/l dissolved oxygen, versus 9.5 mg/l in the surface waters. Decreased dissolved oxygen concentrations in the bottom waters is normally the result of chemical and bacterial decomposition of organic matter; two oxygen consuming processes. The effect of these processes is minimized in Bala Bay, due largely to its large hypolimnetic volume. However, in Dark Lake, which has a much smaller hypolimnetic volume these processes manifested themselves in a total depletion of dissolved oxygen in the bottom 2 meters.

Water Chemistry

The alkalinity, hardness and conductivity values of 6 mg/l as $CaCO_3$, 14 mg/l as $CaCO_3$ and 45 unhos/cm^3 typify a soft water Pre-cambrian Shield lake, with a weak bicarbonate buffering system.

* unless otherwise noted, results refer to both Bala Bay and Dark Lake.

The pH of the bottom waters (6.4) was slightly more acidic than the surface water pH of 6.8, though in general, the pH was close to neutrality.

The total iron concentration in the surface waters was below the level where problems of sedimentation in pipes or staining can be encountered. Higher total iron concentrations were evident in the bottom waters at both lake stations. These concentrations are sufficient to cause the previously mentioned problems, however, water from these depths is unlikely to be used.

Nutrient Characteristics

The nutrient concentrations in Bala Bay were generally low, and comparable to other oligotrophic lakes previously studied. The mean total phosphorus and Kjeldahl nitrogen concentrations were 7 ugP/l and 0.22 mgN/l respectively, which were lower than those measured in Lake Muskoka (1969-70). The nitrate-nitrogen concentration was slightly higher than normally associated with oligotrophic lakes, averaging 0.14 mgN/l in the surface waters, and 0.28 mgN/l in the bottom waters. No enrichment associated problems are expected to develop as a result of this, as the concentration of phosphorus, which is recognized as the limiting element required for growth, is well below the level where nuisance growths of algae or aquatic plants can be expected to materialize.

Dark Lake's surface water total phosphorus and Kjeldahl nitrogen concentrations (7 ugP/l and 0.27 mgN/l) were similar to Bala Bay's, although higher concentrations of both were present in the bottom waters (19 ugP/l and 0.45 mgN/l). Ammonia concentrations in the bottom waters (0.16 mg/l) were also elevated over surface concentrations (0.05 mg/l) probably in response to higher bottom water Kjeldahl nitrogen concentrations. Dark

Lake's nitrate concentration (0.10 mg/l) was lower than Bala Bay's.

The water chemistry of the inflows was similar to that of Bala Bay with the exception of the waters from Brandy Creek (Station 14), which had higher total phosphorus (16 ug/l) and higher total Kjeldahl nitrogen (0.36 mg/l). This is not unusual, considering a large portion of the Creek's drainage basin is marsh. The effect of these elevated concentrations is expected to be minimal, and restricted to the vicinity of the Creek's mouth.

Transparency and Chlorophyll a

The following table summarizes the Secchi disc readings, and chlorophyll a concentrations for Bala Bay and Dark Lake:

	Secchi Disc-m.		Chlorophyll a - ug/l	
	mean	range	mean	range
Bala Bay	6.2	5.0-7.5	1.6	0.4-3.2
Dark Lake	5.5	4.0-7.0	3.0	2.1-5.8

Both bodies of water exhibited a high degree of water transparency, as determined by the Secchi disc readings, though the transparency of Bala Bay was greater. The concentration of chlorophyll a, the predominant algal photosynthetic pigment, provides an indication of the suspended algae concentration. The mean chlorophyll a concentration for Bala Bay is indicative of low algal concentrations. Dark Lake's chlorophyll a concentrations indicate moderate algal densities.

Overall Water Quality Status

The general enrichment status of a lake, compared with other lakes, can

be readily obtained by plotting the mean values for chlorophyll a and Secchi disc readings on a graph which has been derived by staff of the Ministry of the Environment, relating these two parameters.

Appendix II illustrates the position of Bala Bay and Dark Lake relative to a number of other lakes in Muskoka-Haliburton. Bala Bay compares favourably with Lake Rosseau, a previously surveyed oligotrophic lake, while Dark Lake is slightly more enriched.

Generally, a lake can be considered oligotrophic if:

1) the mean Secchi disc readings for the ice-free period is greater than 5.0 meters
2) the mean euphotic zone (2 x the Secchi disc depth) total phosphorus concentration for the ice-free period is less than 10 ug/l

   and
3) the mean chlorophyll a concentration for the ice-free period is less than 2.0 ug/l

Oligotrophic lakes typically provide suitable habitat for cold water fish species, contain nutrient concentrations which are not sufficient to support nuisance growths of algae or aquatic weeds, and exhibit a high degree of transparency.

Bala Bay meets these requirements for an oligotrophic lake and although Dark Lake meets two of them, the following signs of eutrophication were also present:

1) the bottom 2 meters of water were devoid of oxygen by the end of September

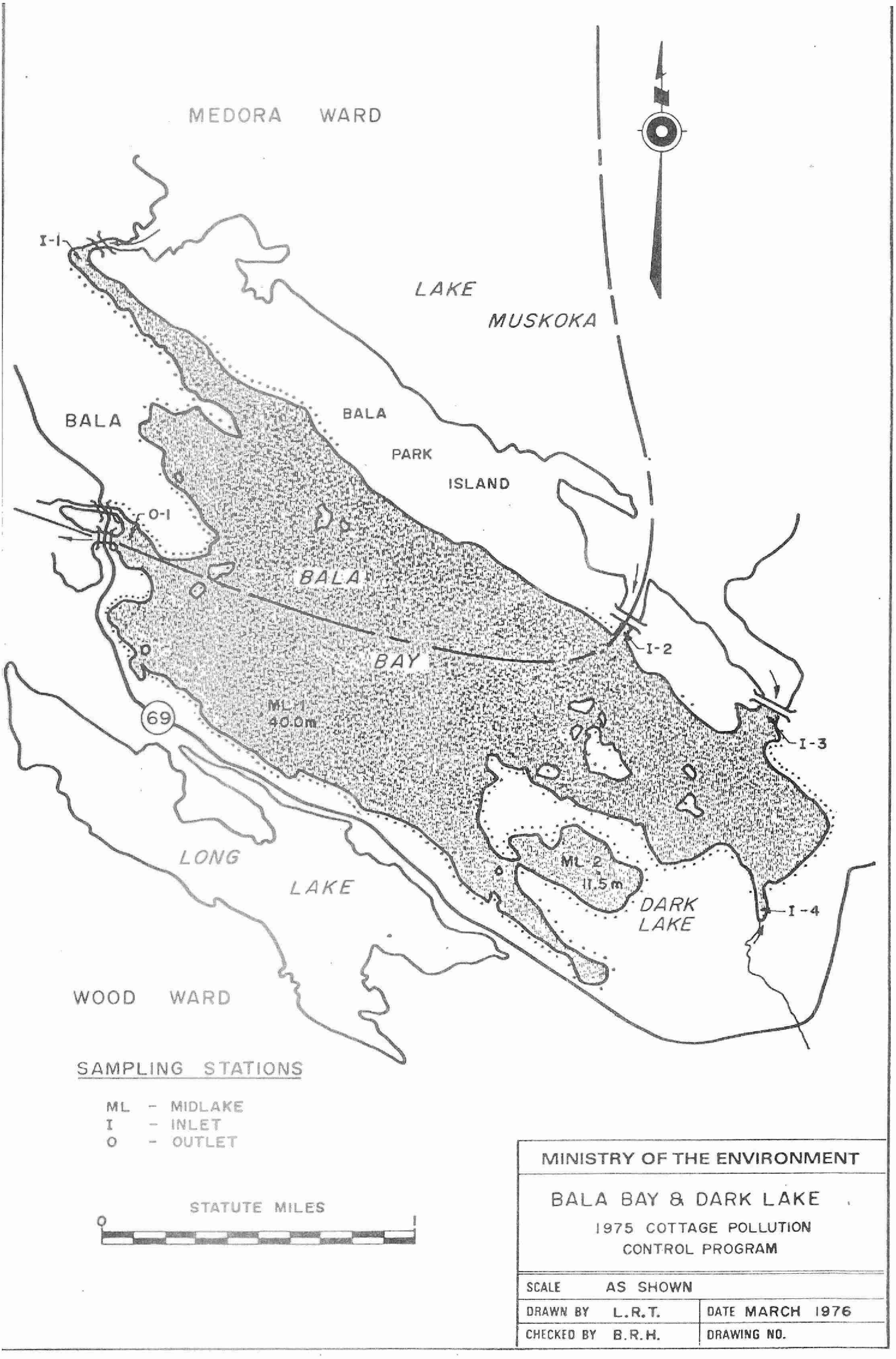
2) higher concentrations of nutrients than in the surface waters prevailed in the bottom waters throughout the survey.

Neither of these factors, however, will affect existing water oriented recreational activities.

The following table compares water quality parameters measured during this survey to those measured during the 1971 survey of Bala Bay and Dark Lake.

	Secchi Disc-m	Chlorophyll a-ug/l
Bala Bay - 1971	4.2	1.7
1975	6.2	1.6
Dark Lake - 1971	4.5	2.9
1975	4.5	3.1

This table indicates, that within the range of natural fluctuation there has been no measurable alteration of water quality in the intervening years. It is expected that both of these bodies of water will continue to provide well suited habitat for the pursuit of water oriented recreational activities.



TRANSLAR 250-9-75

GULL LAKE AND SILVER LAKE

Gull and Silver Lakes are located in Muskoka and Morrison Wards of the Town of Gravenhurst.

The north west sector of Gull Lake borders the urban area of the Town of Gravenhurst.

Silver Lake lies at the east end of Gull Lake and the lakes are connected by Silver Narrows, a channel which is navigable by small pleasure craft.

The northerly shoreline of Gull and Silver Lakes is predominated by steep rocky hills with minimal sandy overburden. The southerly shoreline has somewhat greater overburden depth; however, many natural rock formations protrude to the surface.

The 138 sewage disposal systems on Gull Lake were inspected during the summer of 1976. Twenty-three or 17% of these systems were classified as seriously substandard; 51 or 37% were unsatisfactory due to improper disposal of solid waste or wash water; and 8 or 6% of the systems were classified as direct polluters.

Of the 37 private sewage disposal systems inspected on Silver Lake, 8 or 22% were found to be seriously substandard; 11 or 30% were unsatisfactory due to improper disposal of solid waste or wash water; and no systems were classified as direct polluters. (See Appendix I for classification information.)

Water Quality - Gull Lake, Gravenhurst

Three stations, the inlet (Stn. 17), outlet (Stn. 8) and one lake station (Stn. 11), were sampled on nine separate occasions from May 23rd to September 25th, 1975. The location of the stations are shown on the map of Gull Lake. During each visit, chemical samples were collected at the inlet and outlet stations, plus an additional sample for chlorophyll a determination from the inlet.

The following activities were conducted during each visit to the lake station:

a) the degree of water transparency was determined using a Secchi disc (30 cm disc divided into opposing black and white quadrants).
b) dissolved oxygen and temperature profiles were recorded using an electronic meter.
c) euphotic zone composite samples for chemical and chlorophyll a analysis were collected.
d) bottom water samples (1 meter above bottom) were collected for chemical analysis.

Analyses for the following parameters was performed on all chemical samples:
Alkalinity, hardness, conductivity, pH, total iron, total phosphorus, soluble phosphorus, total Kjeldahl, nitrogen, ammonia-nitrogen, nitrate-nitrogen, nitrite-nitrogen, chloride, and colour.

RESULTS AND DISCUSSION

Temperature and Dissolved Oxygen

The shallow nature of Gull Lake (max. depth 7.0 m) inhibits thermal stratification, resulting in relatively constant temperatures throughout the water column. The maximum surface temperature recorded was 25°C.

Although there was a depression of the dissolved oxygen concentration with depth, the water column was well oxygenated. The bottom water concentration remained in excess of 6 mg/l dissolved oxygen.

Water Chemistry

The mean alkalinity, hardness and conductivity values of 8 mg/l as $CaCO_3$, 15 mg/l as $CaCO_3$ and 57 umhos/cm^3 are indicative of a soft water Pre-Cambrian Shield lake, with a weak bicarbonate buffering system.

The pH of the bottom waters (6.5) was slightly more acidic than the surface water pH of 6.8, though in general, the pH of the lake was close to neutrality.

The mean bottom water (1 meter above bottom) total iron concentration of 0.23 mg/l was elevated over the surface water concentration (0.12 mg/l); however, at these levels, problems due to staining and sedimentation in pipes are not expected to materialize.

Nutrient Characteristics

The concentration of phosphorus and nitrogen, nutrients required for the growth of aquatic plants and algae, was relatively low and remained uniform throughout the lake.

The following table is a summary of the data collected.

Station	[Phosphorus] ug/l		[Kjeldahl nitrogen] mg/l	
	range	mean	range	mean
11 (lake)	5-22	10	0.23-0.38	0.27
17 (inlet)	6-10	8	0.25-0.34	0.29

Enrichment associated problems would not be expected to develop at these concentrations.

Transparency and Chlorophyll a

The Secchi disc readings for Gull Lake were high, ranging from 4.0 to 6.0 meters, averaging 5.0 meters. The water colour values were low, which combined with the Secchi disc readings, indicates clear water, with a high degree of transparency.

The concentration of chlorophyll a, the predominant algal photosynthetic pigment, provides an indication of the suspended algae concentration. The chlorophyll a concentration for Gull Lake ranged from 0.8 to 3.1 ug/l, averaging 2.4 ug/l; indicating moderately low algal densities.

BACTERIOLOGY

Two, five day bacteriological surveys were carried out from June 6th to June 10th and July 11th to July 15th. Samples were collected daily from the outlet, inlet, three open lake stations, and 16 shoreline locations considered to be representative of the various degrees of shoreline development. The number of bacteria in each of the four kinds of "indicator" organisms - total coliform, faecal coliform, faecal streptococcus bacteria, and Psuedomonas aeruginosa, were determined on each sample. The methodology used for sample analysis and the analysis of the data is available upon request from the Microbiology Section, Laboratory Services, Ministry of the Environment, Rexdale.

During the June and July surveys, the bacteriological water quality of Gull Lake was generally good and with the exception of a few areas of intermittent contamination, thought to be due to storm water or animal inputs, was within the Ministry of the Environment microbiological criteria for total body contact recreational use which states:

"Where ingestion is probable, recreational waters can be considered impaired when the coliform (T.C.) faecal coliform (F.C.) and/or enterococcus (faecal streptococcus, F.S.) geometric mean density exceeds 1,000,100, and/or 20 per 100 ml. respectively in a series of at least 10 samples per month, including samples collected during week-end periods". *

Pseudomonas aeruginosa were isolated only in the vicinity of public bathing beaches during the surveys, and had low geometric mean densities of about 3 per 100 ml. Staphylococcus aureus was isolated near the public beach during the July survey at a level of 4 per 100 ml. These bacteria are carried normally by people, and shed on bathing, so that their isolation at the bathing beaches reflects the intensive use of these

areas by the public. These bacteria may cause eye, ear, or skin infections, but the degree of hazard to bathers is hard to establish as the detected levels were very low. It is generally considered however, that waters used for bathing should be free of pathogens.*

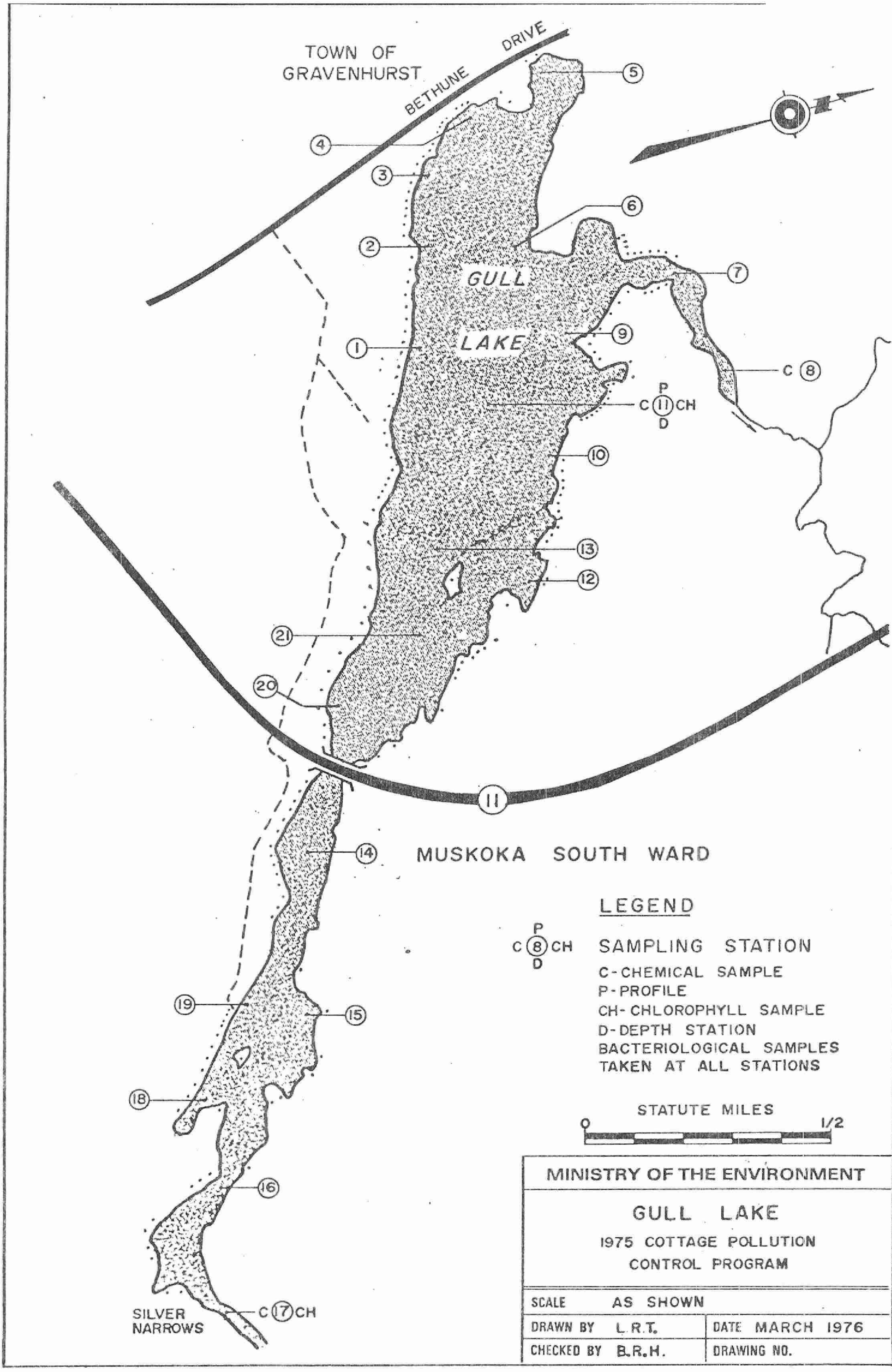
Overall Water Quality Status

The general enrichment status of the lake, compared with other lakes, can be readily obtained by plotting the mean values for chlorophyll a and Secchi disc readings on a graph relating these two parameters, which has been derived by staff of the Ministry of the Environment.

Appendix II illustrates the position of Gull Lake relative to a number of other lakes in Muskoka-Haliburton. Gull Lake compares favourably to Peninsula Lake, a previously studied deep water lake of relatively low enrichment status.

The nutrient concentrations, the degree of transparency and the algal concentrations indicate that the enrichment status of Gull Lake is moderately low, and it is expected that the lake will continue to provide a well suited habitat for the pursuit of water oriented recreational activities.

* Ministry of the Environment, 1974, Guidelines and Criteria for Water Management in Ontario.



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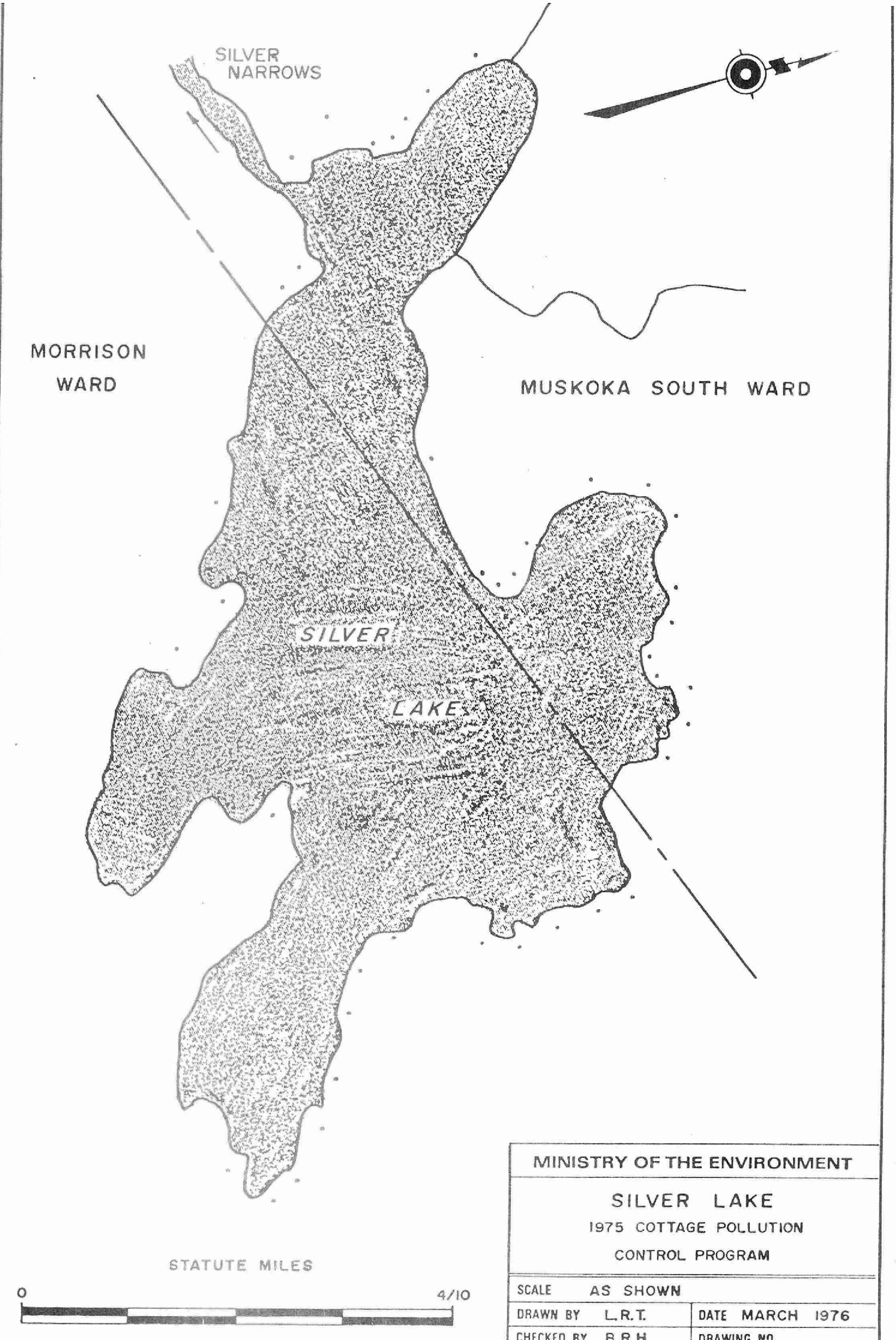


MINISTRY OF THE ENVIRONMENT

SILVER LAKE

1975 COTTAGE POLLUTION CONTROL PROGRAM

SCALE AS SHOWN	
DRAWN BY L.R.T.	DATE MARCH 1976
CHECKED BY B.R.H.	DRAWING NO.

TRANSLAR 250-9-73

THREE MILE LAKE

Three Mile Lake is located in the Township of Muskoka Lakes, approximately 16 kilometers (10 miles) north west of the Town of Bracebridge.

The Lake lies in the Precambrian Shield at an elevation of 24 meters (810 feet) above sea level. The surrounding topography is characterized by rolling hills of bed rock covered with overburden which is generally shallow and is composed of clay and sand glacial till with a moderate amount of stone.

The surface area of Three Mile Lake is 8.8 square kilometers (3.4 square miles) including three small islands. These are Balthaycock Island at the east end of the lake, Lottie Island at the west end and an unnamed island at the entrance to Hammel Bay.

All of the 542 private sewage disposal systems on Three Mile Lake were inspected during the summer of 1975. Of these systems, 76 or 14% were classified as seriously substandard, 193 or 36% were unsatisfactory due to improper disposal of solid waste or wash water and 2 were classified as direct polluters. (See Appendix 1 for classification information).

Due to the lack of sufficient granular soil cover over bedrock or clay it is necessary for granular fill to be imported to some lots to develop a suitable area for sub-surface sewage disposal. Corrective action has been initiated on some disposal systems and the remainder will commence corrective work during the summer of 1976.

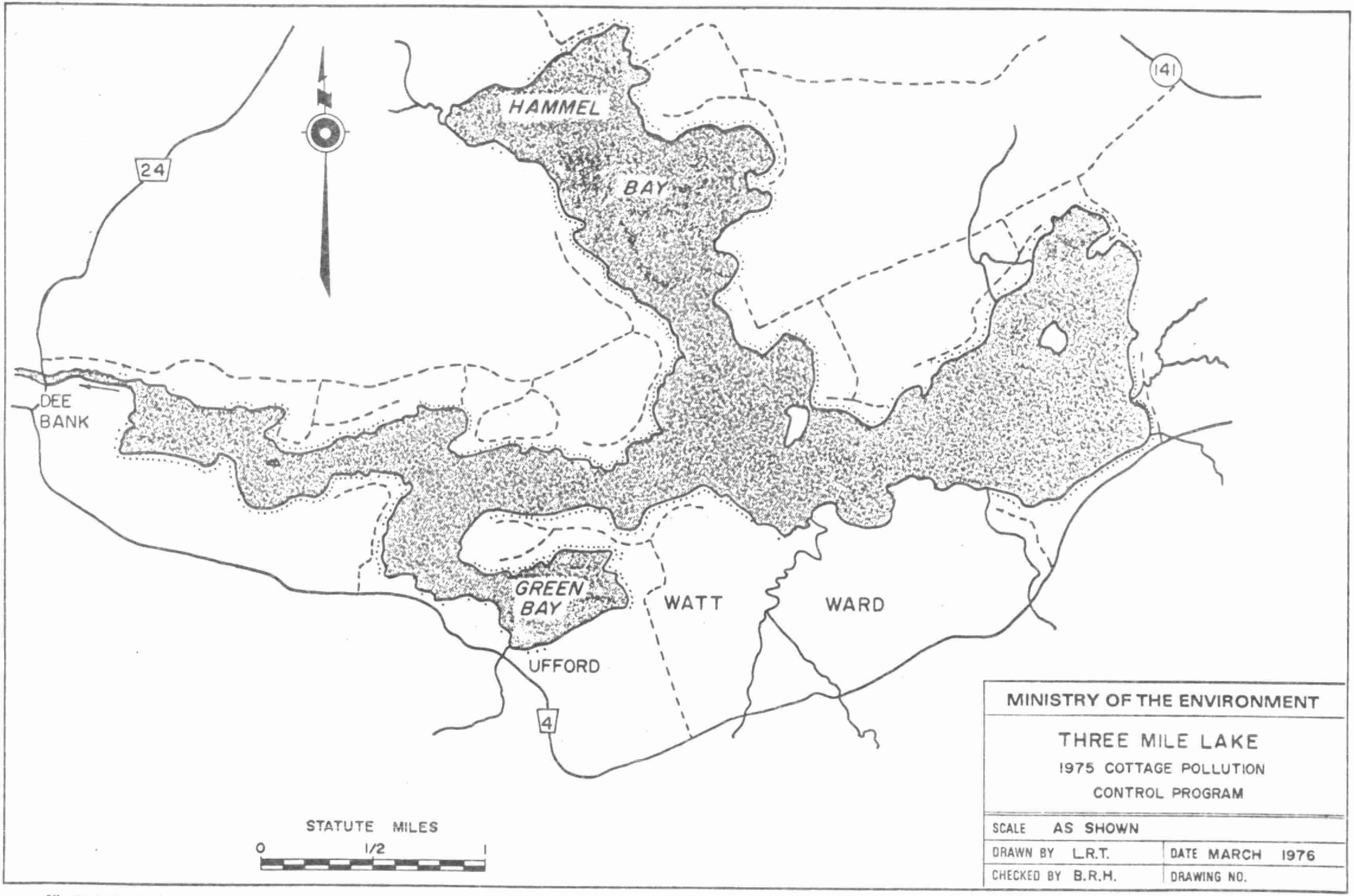
WATER QUALITY - THREE MILE LAKE

A water quality survey of Three Mile Lake was conducted in 1972, under the Recreational Lakes Program. The results of that survey have been reported in the Ministry of the Environment publication Report on Water Quality in Three Mile Lake, 1972. The following is a brief summary of the report.

The bacteriological quality of Three Mile Lake was good, and well within the Ministry of the Environment Recreational Use Criteria; however, higher bacterial densities at three inlets indicated possible pollution inputs.

The bottom water dissolved oxygen concentration in Hammel Bay was severely depleted by late summer, although the remainder of the Lake, because of its shallowness, remained well oxygenated.

Chemical analyses indicated the Lake to be slightly acidic soft water, with relatively high iron concentrations. The algal densities were moderate, although water transparency was poor; probably a result of water colouration and suspended solids. Relatively high nutrient concentrations indicated that the Lake can support nuisance growth of algae and/or aquatic weeds.



TRANSLAR 250-9-75

GULL LAKE (HALIBURTON)

Gull Lake is located in Lutterworth Township, Provisional County of Haliburton, 9 kilometers (5 miles) south west of the Town of Minden.

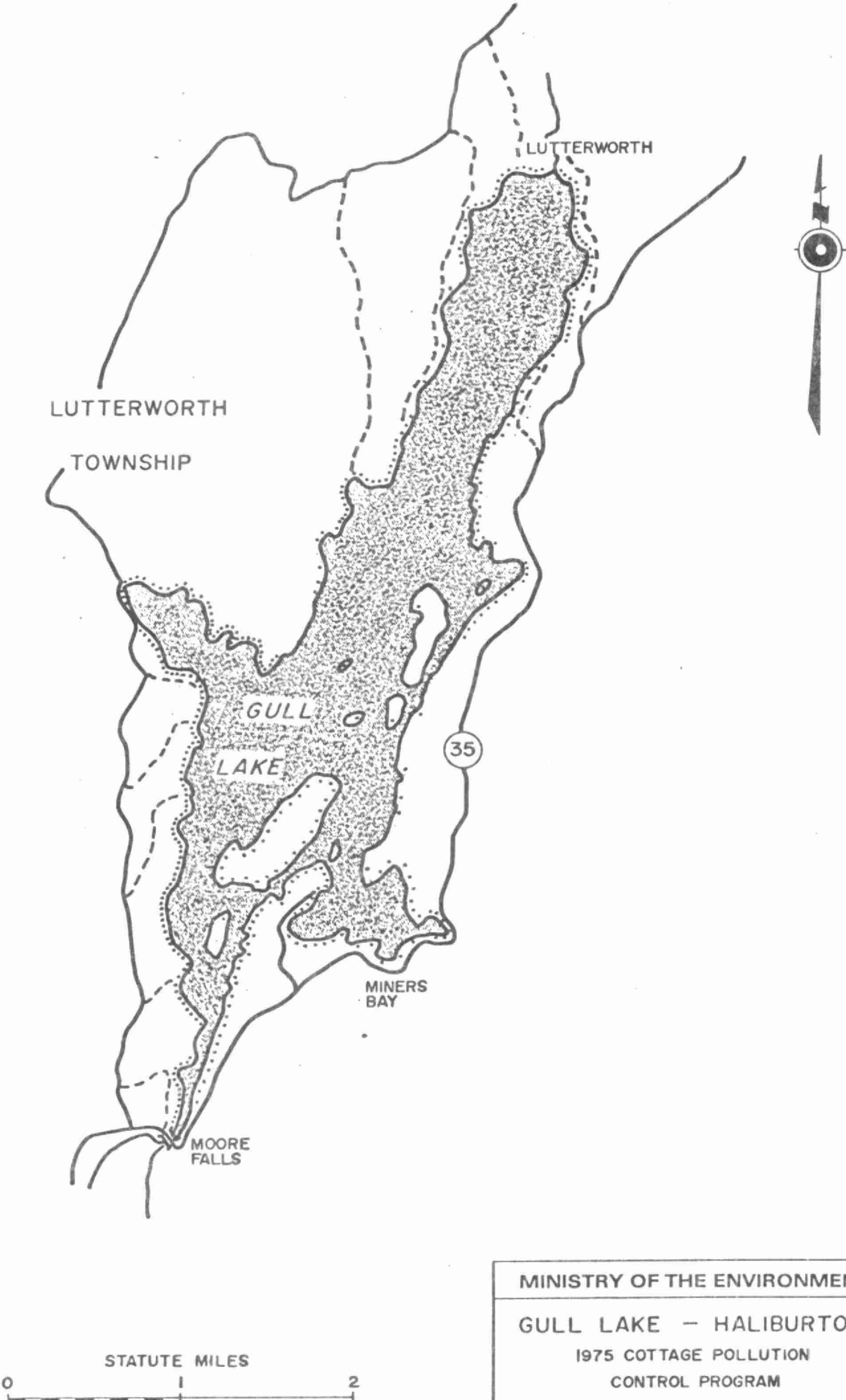
The shoreline of Gull Lake is generally steep and rocky with much exposed bedrock. The overburden found throughout the shoreline is sandy glacial till with pockets of clay. Deep Bay in the north west shoreline and Miners Bay near the south end of the lake are the predominant bays. Several islands, of which Sugar and Long are the largest, are scattered about the central portion of the lake.

The Gull River flows into Gull Lake at the north end and the major outflow is at Moore Falls into Moore Lake at the south end.

On Gull Lake, all of the 413 private sewage disposal systems were inspected and 113 or 27% were found to be seriously substandard; 159 or 38% were unsatisfactory due to improper disposal of solid waste or wash water; and 3 systems were classified as direct polluters.

The lack of sufficient natural soil depth for a standard septic tank and leaching bed deems corrective measures expensive and often complex.

Alternate methods of sewage disposal are being used to correct problems on lots which cannot feasibly support a leaching bed.



MINISTRY OF THE ENVIRONMENT

GULL LAKE – HALIBURTON

1975 COTTAGE POLLUTION CONTROL PROGRAM

SCALE AS SHOWN	
DRAWN BY L.R.T.	DATE MARCH 1976
CHECKED BY B.R.H.	DRAWING NO.

APPENDIX I

PRELIMINARY CLASSIFICATION OF SYSTEMS INSPECTED

MUSKOKA

1975

BODY OF WATER	NUMBER OF SYSTEMS INSPECTED	CLASSIFICATION OF SYSTEMS															
		SATISFACTORY		SATISFACTORY PERFORMANCE		SERIOUSLY SUBSTANDARD		NUISANCE (WASH WATER)		NUISANCE (SOLID WASTE)		DIRECT POLLUTER		UNCLASSIFIED TEMPORARILY		UNCLASSIFIED	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Bala Bay	280	46	16	53	19	72	26	41	15	50	18	5	2	9	3	4	1
Dark Lake	38	7	18	15	39	8	21	4	11	3	8	0	0	1	3	0	0
Gull Lake (G)	138	13	9	31	22	23	17	23	17	28	20	8	6	11	8	1	1
Gull Lake (H)	413	21	5	89	22	113	27	79	19	80	19	3	1	28	7	0	0
Silver Lake	37	4	11	12	32	8	22	4	11	7	19	0	0	2	5	0	0
Three Mile Lake	542	45	8	193	36	76	14	70	13	123	23	2	0	33	6	0	0
TOTAL	1,448	136	9	393	27	300	21	221	15	291	20	18	1	84	6	5	1

APPENDIX II

MEAN CHLOROPHYLL a AND SECCHI DISC MEASUREMENTS

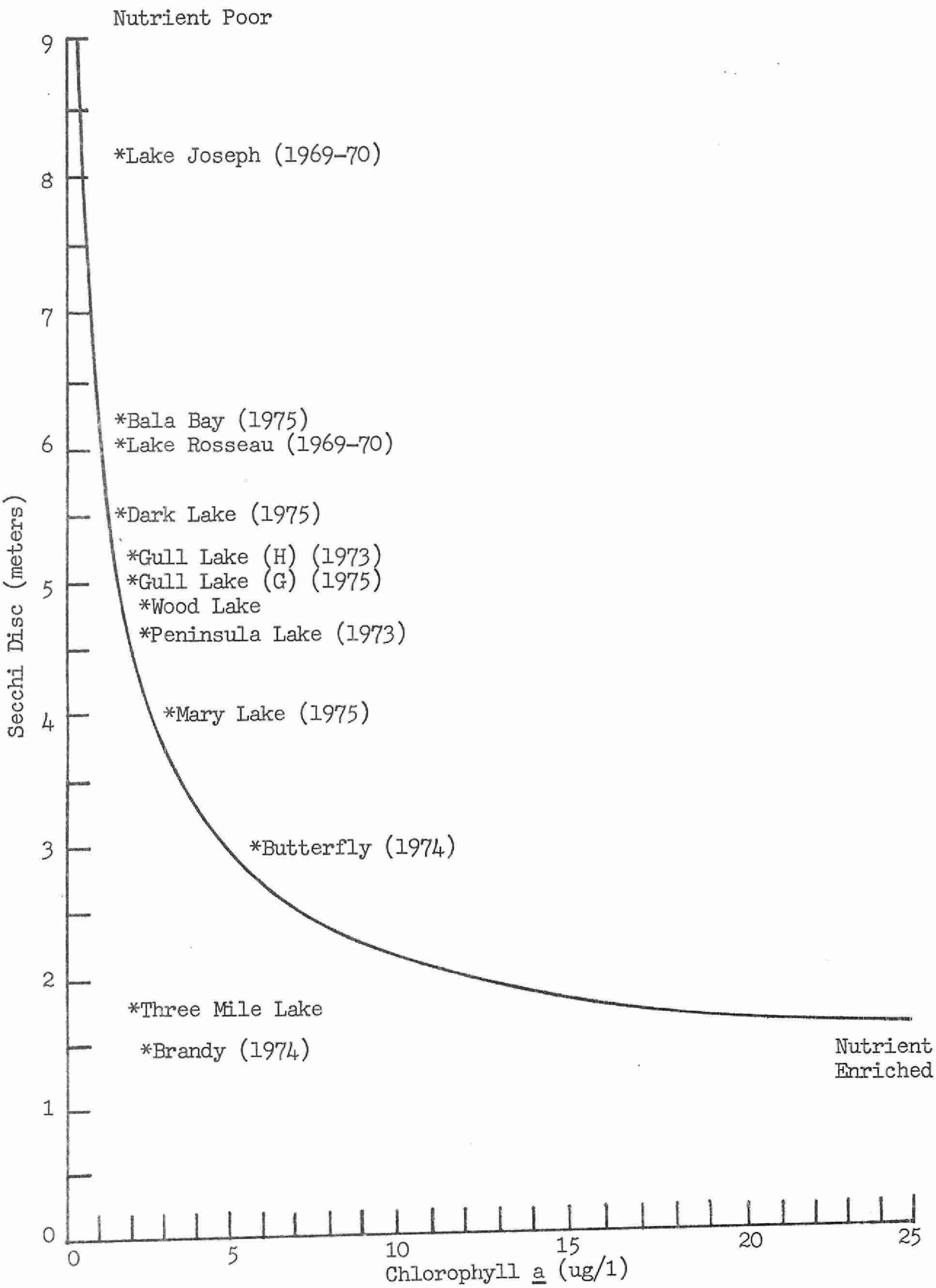


Figure: Mean Chlorophyll a and Secchi Disc Measurements in Bala Bay, Dark Lake, Gull Lake (G), Gull Lake (H), and Three Mile Lake, Relative to Other Muskoka-Haliburton Lakes.

INFORMATION OF GENERAL INTEREST TO COTTAGERS

MICROBIOLOGY OF WATER

For the sake of simplicity, the micro-organisms in water can be divided into two groups: the bacteria that thrive in the lake environment and make up the natural bacterial flora; and the disease causing micro-organisms, called pathogens, that have acquired the capacity to infect human tissues.

The "pathogens" are generally introduced to the aquatic environment by raw or inadequately treated sewage, although a few are found naturally in the soil. The presence of these bacteria does not change the appearance of the water but poses an immediate public health hazard if the water is used for drinking or swimming. The health hazard does not necessarily mean that the water user will contract serious waterborn infections such as typhoid fever, polio or hepatitis, but he may catch less serious infections of gastro-enteritis (sometimes called stomach flu), dysentery or diarrhea. Included in these minor afflictions are eye, ear and throat infections that swimmers encounter every year and the more insidious but seldom diagnosed, subclinical infections usually associated with several waterborn viruses. These viral infections leave a person not feeling well enough to enjoy holidaying although not bedridden. This type of microbial pollution can be remedied by preventing wastes from reaching the lake and water quality will return to satisfactory conditions within a relatively short time (approximately 1 year) since disease causing bacteria usually do not thrive in an aquatic environment.

The rest of the bacteria live and thrive within the lake environment. These organisms are the instruments of biodegradation. Any organic matter in the lake will be used as food by these organisms and will give rise, in turn, to subsequent increases in their numbers. Natural organic matter as well as that from sewage, kitchen wastes, oil and gasoline are readily attacked by these lake bacteria. Unfortunately, biodegradation of the organic wastes by organisms uses correspondingly large amounts of dissolved oxygen. If the organic matter content of the lake gets high enough, these bacteria will deplete the dissolved oxygen supply in the bottom waters and threaten the survival of many deep-water fish species.

RAINFALL AND BACTERIA

The "Rainfall Effect" relates to a phenomenon that has been documented in previous surveys of the Recreational Lakes. Heavy precipitation has been shown to flush the land area around the lake and the subsequent runoff will carry available contaminants including sewage organisms as well as natural soil bacteria with it into the water.

Total coliforms, faecal coliforms and faecal streptococci, as well as other bacteria and viruses which inhabit human waste disposal systems, can be washed into the lake. In Pre-Cambrian areas where there is inadequate soil cover and in fractured limestone areas where fissures in the rocks provide access to the lake, this phenomenon is particularly evident.

Melting snow provides the same transportation function for bacteria, especially in an agricultural area where manure spreading is carried out in the winter on top of the snow.

Previous data from sampling points situated 50 to 100 feet from shore indicate that contamination from shore generally shows up within 12 to 48 hours after a heavy rainfall.

WATER TREATMENT

Lake and river water is open to contamination by man, animals and birds (all of which can be carriers of disease); consequently, NO SURFACE WATER MAY BE CONSIDERED SAFE FOR HUMAN CONSUMPTION without prior treatment including disinfection. Disinfection is especially critical if coliforms have been shown to be present.

Disinfection can be achieved by;

(a) Boiling

Boil the water for a minimum of five minutes to destroy the disease causing organisms.

(b) Chlorination using a household bleach containing 4% - 5% available chlorine.

Eight drops of a household bleach solution should be mixed with one gallon of water and allowed to stand for 15 minutes before drinking.

(c) Continuous Chlorination

For continuous water disinfection, a small domestic hypochlorinator (sometimes coupled with activated charcoal filters) can be obtained from a local plumber or water equipment supplier.

(d) Well Water Treatment

Well water can be disinfected using a household bleach (assuming strength at 5% available chlorine) if the depth of water and diameter of the well are known.

CHLORINE BLEACH
Per 10 ft. Depth of Water

Diameter of Well Casing in Inches	One to Ten Coliforms	More Than Ten Coliforms
4	0.5 oz.	1 oz.
6	1 oz.	2 oz.
8	2 oz.	4 oz.
12	4 oz.	8 oz.
16	7 oz.	14 oz.
20	11 oz.	22 oz.
24	16 oz.	31 oz.
30	25 oz.	49 oz.
36	35 oz.	70 oz.

Allow about six hours of contact time before using the water.

Another bacteriological sample should be taken after one week of use.

Water sources (spring, lake, well, etc.) should be inspected for possible contamination routes (surface soil, runoff following rain and seepage from domestic waste disposal sites). Attempts at disinfecting the water alone without removing the source of contamination will not supply bacteriologically safe water on a continuing basis.

There are several types of low cost filters (ceramic, paper, carbon, diatomaceous earth sometimes impregnated with silver, etc.) that can be easily installed on taps or in water lines. These may be useful to remove particles, if water is periodically turbid, and are usually very successful. Filters, however, do not disinfect water but may reduce bacterial numbers. For safety, chlorination of filtered water is recommended.

SEPTIC TANK INSTALLATIONS

In Ontario, provincial law requires under Part 7 of The Environmental Protection Act that before you extend, alter, enlarge or establish any

building where a sewage system will be used, a Certificate of Approval must be obtained from the Ministry of the Environment or its representatives. The local municipality or Health Unit may be delegated the authority to issue the Certificate of Approval. Any other pertinent information such as size, types and location of septic tanks and tile fields can also be obtained from the same authority.

General Guidelines

A septic tank should not be closer than:

- 50 feet to any well, lake, stream, pond, spring, river or reservoir
- 5 feet to any building
- 10 feet to any property boundary

The tile field should not be closer than:

- 100 feet to the nearest dug well
- 50 feet to a drilled well which has a casing to 25 feet below ground
- 25 feet to a building with a basement that has a floor below the level of the tile in the tile bed
- 10 feet to any other building
- 10 feet to a property boundary
- 50 feet to any lake, stream, pond, spring, river or reservoir

The ideal location for a tile field is in a well-drained, sandy loam soil remote from any wells or other drinking water sources. For the tile field to work satisfactorily, there should be at least 3 feet of soil between the bottom of the weeping tile trenches and the top of the ground water table or bedrock.

Recognizing that private sewage systems are relatively inefficient where shallow and inappropriate soil conditions are present (e.g. Pre-Cambrian areas) the Ministry of the Environment is conducting research into alternate

methods of private sewage disposal in un-sewered areas; into the improvement of existing equipment and methods of design and operation for these systems; and into the development of better surveillance methods such as by the use of chemical, biological and radioactive tracers to detect the movement of pollutants through the soil mantle.

DYE TESTING OF SEPTIC TANK SYSTEMS

There is considerable interest among cottage owners to dye test their sewage systems; however, several problems are associated with dye testing. Dye would not be visible to the eye from a system that has a fairly direct connection to the lake. Thus, if a cottager dye-tested his system and no dye was visible in the lake, he would assume that his system is satisfactory, which might not be the case. A low concentration of dye is not visible and therefore expensive equipment such as a fluorometer is required. Only qualified people with adequate equipment are capable of assessing a sewage system by using dye. In any case, it is likely that some of the water from a septic tank will eventually reach the lake. The important question is whether all contaminants including nutrients have been removed before it reaches the lake. To answer this question special knowledge of the system, soil depth and composition, underground geology of the region and the shape and flow of the shifting water table are required. Therefore, we recommend that this type of study should be performed only by qualified professionals.

BOATING & MARINA REGULATIONS

In order to help protect the lakes and rivers of Ontario from pollution, it is required by law that sewage (including garbage) from all pleasure craft, including houseboats, must be retained in suitable equipment. Equipment which is considered suitable by the Ministry of the Environment

includes (1) retention devices with or without re-circulation which retain all toilet wastes for disposal ashore, and (2) incinerating devices which reduce all sewage to ash.

Equipment for storage of toilet wastes shall:

1. be non-portable
2. be constructed of structurally sound material
3. have adequate capacity for expected use
4. be properly installed, and
5. be equipped with the necessary pipes and fittings conveniently located for pump-out by shore-based facilities (although not specified, a pump-out deck fitting with $1\frac{1}{2}$ inch diameter National Pipe Thread is commonly used).

Ontario Regulation #646 requires that marinas and yacht clubs provide or arrange pump-out service for the customers and members who have toilet-equipped boats. In addition, all marinas and yacht clubs must provide litter containers that can be conveniently used by occupants of pleasure boats.

The following "Tips" may be of assistance to you in boating:

1. Motors should be in good mechanical condition and properly tuned.
2. When a tank for outboard motor testing is used, the contents should not be emptied into the water.
3. If the bilge is cleaned, the waste material must not be dumped into the water.
4. Fuel tanks must not be overfilled and space must be left for expansion if the fuel warms up.

5. Vent pipes should not be obstructed and fuel needs to be dispensed at a correct rate to prevent "blow-back".
6. Empty oil cans must be deposited in a leak-proof receptacle, and
7. Slow down and save fuel.

EUTROPHICATION OR EXCESSIVE FERTILIZATION AND LAKE PROCESSES

In recent years, cottagers have become aware of the problems associated with nutrient enrichment of recreational lakes and have learned to recognize many of the symptoms characterizing nutrient enriched (eutrophic) lakes. It is important to realize that small to moderate amounts of aquatic plants and algae are necessary to maintain a balanced aquatic environment. They provide food and a suitable environment for the growth of aquatic invertebrate organisms which serve as food for fish. Shade from large aquatic plants helps to keep the lower water cool, which is essential to certain species of fish and also provides protection for young game and forage fish. Numerous aquatic plants are utilized for food and/or protection by many species of waterfowl. However, too much growth creates an imbalance in the natural plant and animal community particularly with respect to oxygen conditions, and some desirable forms of life such as sport fish are eliminated and unsightly algae scums can form. The lake will not be "dead" but rather abound with life which unfortunately is not considered aesthetically pleasing. This change to poor water quality becomes apparent after a period of years during which extra nutrients are added to the lake and return to the natural state may also take a number of years after the nutrient inputs are stopped.

Changes in water quality with depth are a very important characteristic of a lake. Water temperatures are uniform throughout the lake in the early spring and winds generally keep the entire volume well mixed.

Shallow lakes may remain well mixed all summer so that water quality will be the same throughout. On the other hand, in deep lakes, the surface waters warm up during late spring and early summer and float on the cooler more dense water below. The difference in density offers a resistance to mixing by wind action and many lakes do not become fully mixed again until the surface waters cool down in the fall. The bottom water receives no oxygen from the atmosphere during this unmixed period and the dissolved oxygen supply may be all used up by bacteria as they decompose organic matter. Cold water fish, such as trout, will have to move to the warm surface waters to get oxygen and because of the high water temperatures they will not thrive, so that the species will probably die out (see Figure next page).

Low oxygen conditions in the bottom waters are not necessarily an indication of pollution but excessive aquatic plant and algae growth and subsequent decomposition in the bottom waters can aggravate the condition and in some cases result in zero oxygen levels in lakes which had previously held some oxygen in the bottom waters all summer. Although plant nutrients normally accumulate in the bottom waters of lakes, they do so to a much greater extent if there is no oxygen present. These nutrients become available for algae in the surface waters when the lake mixes in the fall and dense algae growths can result. Consequently, lakes which have no oxygen in the bottom water during the summer are more prone to having algae problems and are more vulnerable to nutrient inputs than lakes which retain some oxygen.

Like humans, aquatic plants and algae require a balanced "diet" for growth. Other special requirements including those for light and temperature are specific for certain algae and plants. Chemical elements such as nitrogen, phosphorus, carbon, and several others are required and must be in forms which are available for uptake by plants and algae. Growth of algae

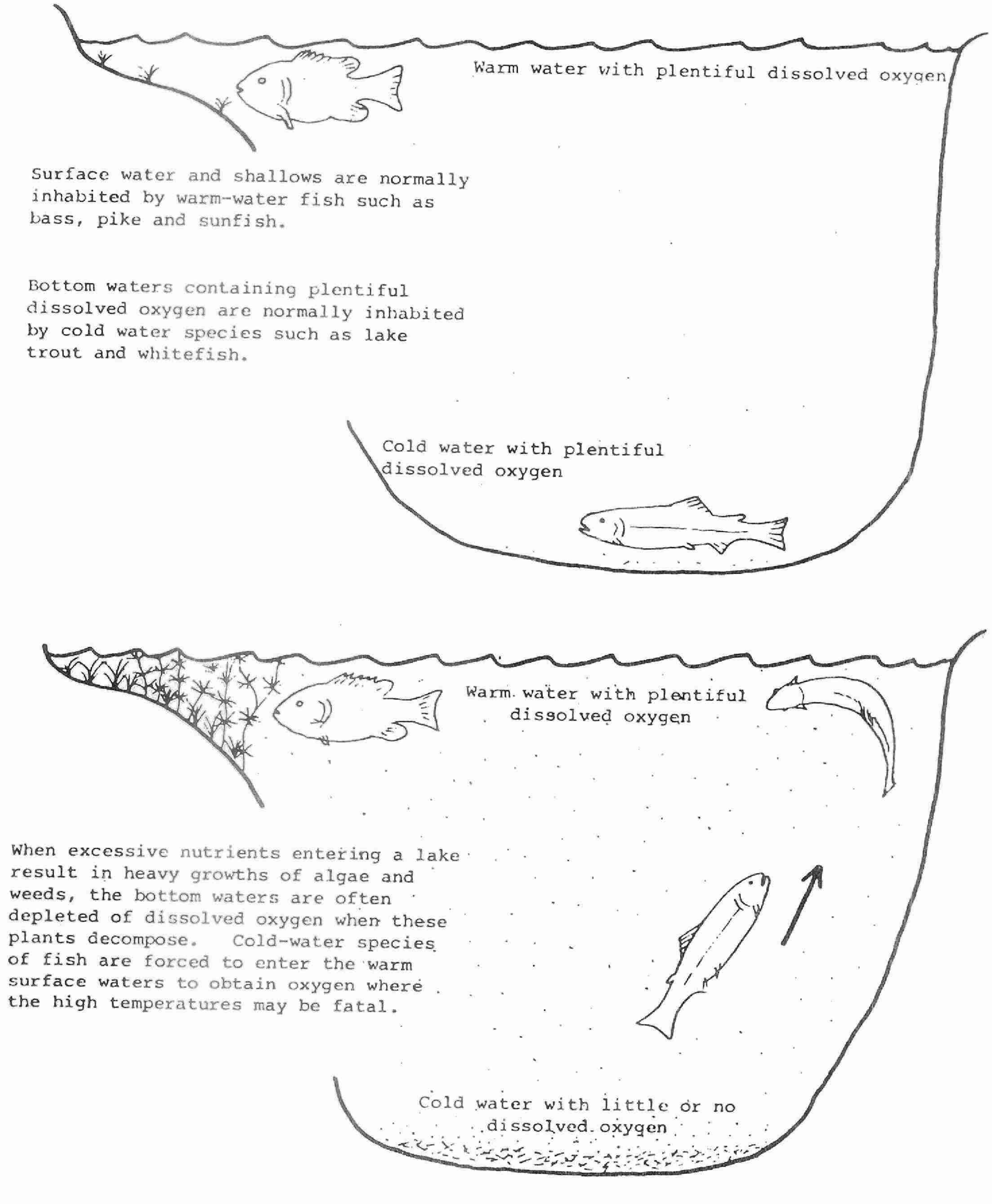
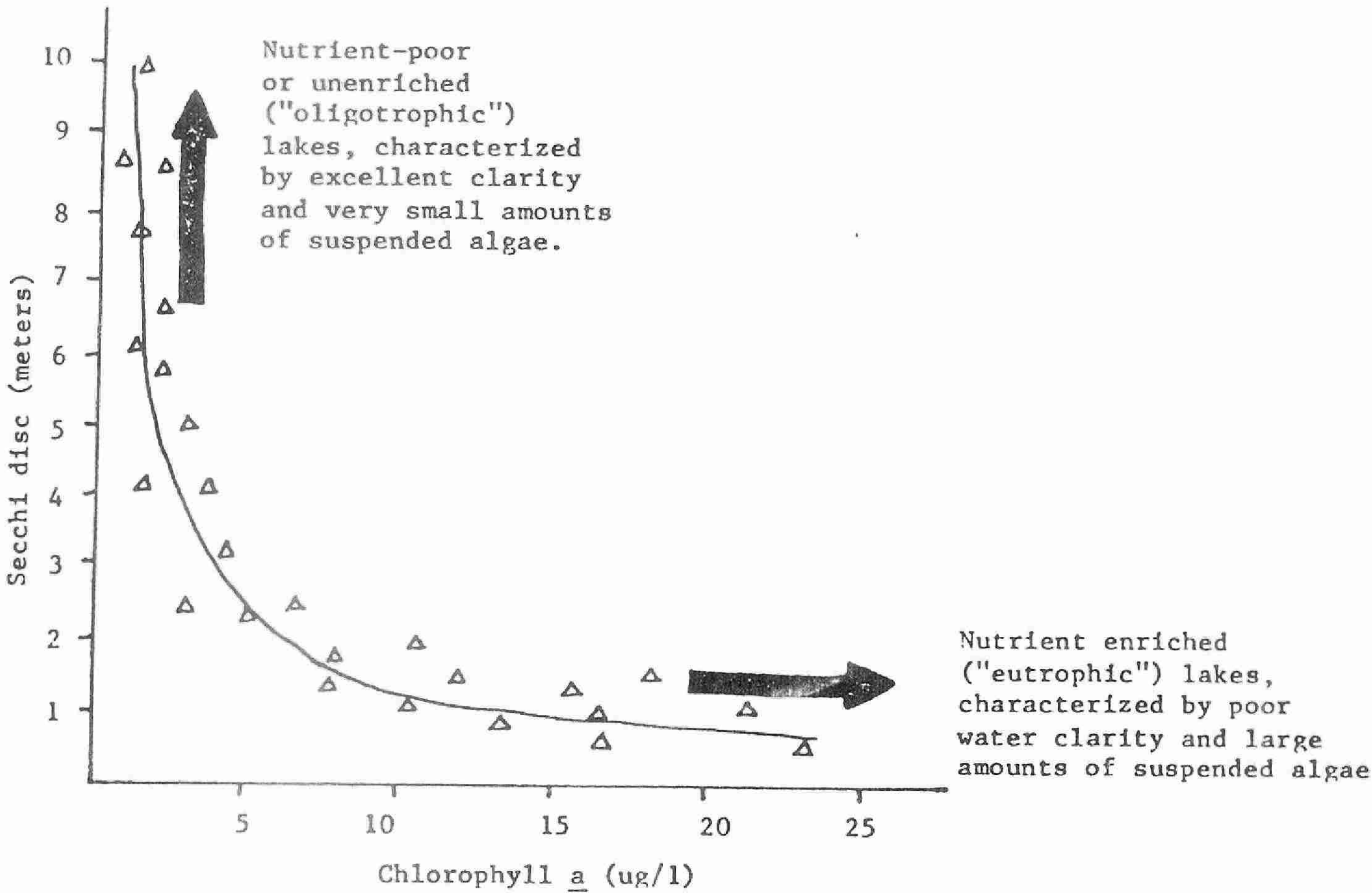


FIGURE A-1: DECOMPOSITION OF PLANT MATTER AT THE LAKE BOTTOM CAN LEAD TO DEATH OF DEEP-WATER FISH SPECIES.

can be limited by a scarcity of any single "critical" nutrient. Nitrogen and phosphorus are usually considered "critical" nutrients because they are most often in scarce supply in natural waters, particularly in lakes in the Pre-Cambrian area of the province. Phosphorus, especially is necessary for the processes of photosynthesis and cell division. Nitrogen and phosphorus are generally required in the nitrate-N (or ammonia-N) and phosphate forms and are present in natural land runoff and precipitation. Human and livestock wastes are a very significant source of these and other nutrients for lakes in urban and agricultural areas. It is extremely important that cottage waste disposal systems function so that seepage of nutrients to the lake does not occur since the changes in water quality brought about by excessive inputs of nutrients to lakes are usually evidenced by excessive growths of algae and aquatic plants.

The large amounts of suspended algae which materialize from excessive inputs of nutrients, result in turbid water of poor clarity or transparancy. On the other hand, lakes with only small, natural inputs of nutrients and correspondingly low nutrient concentrations (characteristically large and deep lakes) most often support very small amounts of suspended algae and consequently are clear-water lakes. An indication of the degree of enrichment of lakes can therefore be gained by measuring the density of suspended algae (as indicated by the chlorophyll a concentration - the green pigment in most plants and algae) and water clarity (measured with a Secchi disc). In this regard, staff of the Ministry of the Environment have been collecting chlorophyll a and water clarity data from several lakes in Ontario and have developed a graphical relationship between these parameters which is being used by cottagers to further their understanding of the processes and consequences of nutrient enrichment of Pre-Cambrian Lakes.

The figure below indicates the previously mentioned relationship.



In the absence of excessive coloured matter (e.g. drainage from marshlands), lakes which are very low in nutrients are generally characterized by small amounts of suspended algae (i.e. chlorophyll a) and are clearwater lakes with high Secchi disc values. Such lakes, with chlorophyll a and Secchi disc values lying in the upper left-hand area of the graph are unenriched or nutrient-poor ("oligotrophic") in status and do not suffer from the problems associated with excessive inputs of nutrients. In contrast, lakes with high chlorophyll a concentrations and poor clarity are positioned in the lower right-hand area of the graph and are enriched ("eutrophic"). These lakes usually exhibit symptoms of excessive nutrient enrichment including water turbidity owing to large amounts of suspended algae which may float to the surface and accumulate in sheltered areas around docks and bays.

Measurements of suspended algal density (chlorophyll a) and water clarity are especially valuable if carried out over several years. Year to year positional changes on the graph can then be assessed to determine whether or not changes in lake water quality are materializing so that remedial measures can be implemented before conditions become critical.

CONTROL OF AQUATIC PLANTS AND ALGAE

Usually aquatic weed growths are heaviest in shallow shoreline areas where adequate light and nutrient conditions prevail.

Extensive aquatic plant and algal growths sometimes interfere with boating and swimming and ultimately diminish shoreline property values.

Control of aquatic plants may be achieved by either chemical or mechanical means. Chemical methods of control are currently the most practical, considering the ease with which they are applied. However, the herbicides and algicides currently available generally provide control for only a single season. It is important to ensure that an algicide or herbicide which kills the plants causing the nuisance, does not affect fish or other aquatic life and should be reasonable in cost. At the present time, there is no one chemical which will adequately control all species of algae and other aquatic plants. Chemical control in the province is regulated by the Ministry of the Environment and a permit must be granted prior to any operation. Simple raking and chain dragging operations to control submergent species have been successfully employed in a number of situations; however, the plants soon re-establish themselves. Removal of weeds by underwater mowing techniques is certainly the most attractive method of control and is currently being evaluated in Chemung Lake near Peterborough. Guidelines and summaries of control methods, and applications for permits are available from the Pesticides Control Section, Ministry

of the Environment, Pesticides Control Section, 12 Fairview Road, Box 937, Barrie, Ontario.

PHOSPHORUS AND DETERGENTS

Scientists have recognized that phosphorus is the key nutrient in stimulating algal and plant growth in lakes and streams.

In the past year, approximately 50% of the phosphorus contributed by municipal sewage was added by detergents. Federal regulations reduced the phosphate content of P_2O_5 in laundry detergents from approximately 50% to 20% on August 1, 1970 and to 5% on January 1, 1973.

It should be recognized that automatic dishwashing compounds were not subject to the government regulations and that surprisingly high numbers of automatic dishwashers are present in resort areas (a questionnaire indicated that about 30 percent of the cottages in the Muskoka lakes have automatic dishwashers). Cottagers utilizing such conveniences may be contributing significant amounts of phosphorus to recreational lakes because automatic dishwashing compounds are characteristically high in phosphorus. In most of Ontario's vacation land the source of domestic water is soft enough to allow the exclusive use of liquid dishwashing compounds or soap and soap-flakes which are relatively low in phosphorus.

ONTARIO'S PHOSPHORUS REMOVAL PROGRAMME

In 1976, the Government of Ontario expects to have controls in operation at more than 200 municipal wastewater treatment plants across the province serving some 4.7 million persons. This represents about 90 percent of the population serviced by sewers. The programme is in response to the International Joint Commission recommendations as embodied in the Great

Lakes Water Quality Agreement and studies carried out by the Ministry of the Environment on inland recreational waters which showed phosphorus to be a major factor influencing eutrophication. Specifically, the programme makes provision for nutrient control in the Upper and Lower Great Lakes, the Ottawa River system and in prime recreational waters where the need is demonstrated or where emphasis is placed upon prevention of localized, accelerated eutrophication.

Phosphorus removal facilities became operational at waste-water treatment plants on December 31, 1973, in the most critically affected areas of the province, including all the plants in the Lake Erie drainage basin and the inland recreational areas. The operational date for plants for discharging to waters deemed to be in less critical condition, which includes plants larger than one million gallons per day (1 mgd) discharging to Lake Ontario and to the Ottawa River system, was December 31, 1975. The 1973 phase of the programme involved 113 plants, of which 48 are in prime recreational areas. An additional 53 new plants, each with phosphorus removal, are now under development, 23 of which are located in recreational areas. The capacities of these plants range from 0.04 to 24.0 mgd, serving an estimated population of 1,600,000 persons.

The 1975 phase brought into operation another 54 plants ranging in size from 0.3 to 180 mgd serving an additional 3,100,000 persons. Treatment facilities utilizing the Lower Great Lakes must meet effluent guidelines of less than 1.0 milligram per litre of total phosphorus in their final effluent. Facilities utilizing the Upper Great Lakes, the Ottawa River Basin and certain areas of Georgian Bay where needs have been demonstrated must remove at least 80 percent of the phosphorus reaching their sewage treatment plants.

CONTROL OF BITING INSECTS

Mosquitoes and blackflies often interfere with the enjoyment of recreational facilities at the lakeside vacation property. Pesticidal spraying or fogging in the vicinity of cottages produces extremely temporary benefits and usually do not justify the hazard involved in contaminating the nearby water. Eradication of biting fly populations is not possible under any circumstances and significant control is rarely achieved in the absence of large-scale abatement programmes involving substantial funds and trained personnel. Limited use of approved larvicides in small areas of swamp or in rain pools close to residences on private property may be undertaken by individual landowners, but permits are necessary wherever treated waters may contaminate adjacent streams or lakes. The use of repellents and light traps is encouraged as are attempts to reduce mosquito larval habitat by improving land drainage. Applications for permits to apply insecticides as well as technical advice can be obtained from the Ministry of the Environment, Pesticides Control Section, 12 Fairview Road, Box 937, Barrie, Ontario.